



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/711,641

09/29/2004

Ishtiaq Ahsan

FIS920040172US1

5640

32074

7590

03/07/2006

INTERNATIONAL BUSINESS MACHINES CORPORATION

DEPT. 18G

BLDG. 300-482

2070 ROUTE 52

HOPEWELL JUNCTION, NY 12533

EXAMINER

DOLE, TIMOTHY J

ART UNIT

PAPER NUMBER

2858

DATE MAILED: 03/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/711,641

Applicant(s)

AHSAN ET AL.

Examiner

Timothy J. Dole

Art Unit

2858

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 September 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 9/29/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Claim Objections

1. Claims 8-10 are objected to because of the following informalities: the semicolon in the first line of claim 8 should be a colon and the semicolon in the fifth line of claim 9 should be a dash. Claim 10 is objected to for indirectly and directly depending on objected claims 8 and 9, respectively. Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-9 and 11-19 are rejected under 35 U.S.C. 102(b) as being anticipated by Usui (US 6,091,080).

Referring to claims 1, 6, 11, 12 and 16, Usui discloses a method and apparatus for detecting metal extrusion associated with electromigration (EM) under high current density situations (abstract) within two or more EM test lines (fig. 4 (12) and (15)) within a circuit, the method being characterized by the steps of: situating the ends of one or more electrically conductive leads (fig. 3 (17)) close to one or more anticipated locations of metal extrusion associated with electromigration on one of the two or more EM test lines (figs. 3, 5A and 5B), such that each end of each electrically conductive lead in combination with each of the one or more anticipated locations of metal extrusion on each of the two or more EM test lines together comprise two charge storing surfaces of

one or more capacitors each having an electrical capacitance (column 5, lines 33-43 and column 6, lines 23-46); measuring the capacitance of each of the one or more capacitors prior to operation of the EM test lines (column 3, lines 13-15); making subsequent measurements of the capacitance of each of the one or more capacitors during or after operation of the EM test lines (column 3, lines 15-18); and detecting changes in the capacitance of each of the one or more capacitors to detect metal extrusion associated with electromigration (column 3, lines 18-23).

Referring to claims 2 and 13, Usui discloses the method and apparatus as claimed, further comprising situating one or more additional ends of one or more additional electrically conductive leads (fig. 8 (17)) close to the single anticipated location of metal extrusion associated with electromigration on the EM test line (fig. 8), such that the end of each additional electrically conductive leads in combination with the single anticipated location of metal extrusion comprise charge storing surfaces of one or more additional capacitors each having an electrical capacitance (column 7, lines 57-63); measuring the capacitance of the single capacitor and the capacitances of the one or more additional capacitors prior to operation of the EM test line (column 3, lines 13-15); making subsequent measurements of the capacitance of the single capacitor and the capacitances of the one or more additional capacitors during or after operation of the EM test line (column 3, lines 15-18); and detecting changes in the capacitance of the single capacitor and the capacitances of the one or more additional capacitors to detect metal extrusion associated with electromigration (column 3, lines 18-23).

Referring to claim 3, 5 and 15 Usui discloses the method and apparatus as claimed, further including: connecting the single capacitor and the one or more additional capacitors in parallel (column 7, lines 60-63) to comprise a module (figs. 2, 8 and 14). It should be noted that since respective capacitive measurements are being taken, each capacitor would have an associated capacitance meter (fig. 2 (3)) and therefore it could be said that the capacitors and the measurements of each capacitor are taken in parallel.

Referring to claims 4 and 14, Usui discloses the method and apparatus as claimed, further including: situating one or more additional ends of each of one or more additional electrically conductive leads (fig. 14) close to one or more additional possible locations of metal extrusion associated with electromigration on the EM test line (fig. 14), such that each end of each electrically conductive lead in combination with each additional possible location of metal extrusion together comprise charge storing surfaces of one or more additional capacitors each having an electrical capacitance (column 9, lines 11-30); measuring the capacitance of the single capacitor and the capacitances of each of the one or more additional capacitors prior to operation of the EM test line (column 3, lines 13-15); making subsequent measurements of the capacitance of the single capacitor and the capacitances of the one or more additional capacitors during or after operation of the EM test line (column 3, lines 15-18); and detecting changes in the capacitance of the single capacitor and the capacitances of the one or more additional capacitors to detect metal extrusion associated with electromigration (column 3, lines 18-23).

Referring to claims 7 and 17, Usui discloses the method and apparatus as claimed, further including: connecting the one or more capacitors comprised of ends of one or

more electrically conductive leads (fig. 3 (17)) close to one or more single anticipated locations of metal extrusion on each of the two or more EM test lines (fig. 4 (12) and (15)) in parallel to create a capacitive extrusion monitor module for each EM test line (figs. 2, 5A and 5B); measuring the capacitance of each module on each of the two or more EM test lines prior to operation (column 3, lines 13-15); making subsequent measurements of the capacitance of each module during or after operation of the EM test line (column 3, lines 15-18); and detecting changes in the capacitance of each module to detect metal extrusion associated with electromigration (column 3, lines 18-23).

Referring to claims 8 and 18, Usui discloses the method and apparatus as claimed, further including: connecting in parallel two or more of each of the capacitive extrusion monitor modules of each of the two or more EM test lines within the circuit to create one or more capacitive extrusion monitor meta-modules (figs. 2, 5A and 5B); measuring the capacitance of each meta-module prior to operation (column 3, lines 13-15); making subsequent measurements of the capacitance of each meta-module during or after operation (column 3, lines 15-18); and detecting changes in the capacitance of each meta-module to detect metal extrusion associated with electromigration (column 3, lines 18-23). It should be noted that since respective capacitive measurements are being taken, each monitor module would have an associated capacitance meter (fig. 2 (3)) and therefore it could be said that the monitor modules are taken in parallel.

Referring to claims 9 and 19, Usui discloses the method and apparatus as claimed, further including: connecting in parallel two or more of each of the capacitive extrusion monitor meta-modules (figs. 2, 5A, 5B and 14); and equipping all of the two or more

Art Unit: 2858

capacitive extrusion monitor meta-modules with a decoder (fig. 2 (4)) to determine the meta-module in which metal extrusion has occurred (column 9, lines 11-30).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 10 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Usui in view of Lowitz et al. (US 6,598,182).

Referring to claims 10 and 20, Usui discloses the method and apparatus as claimed except for step of incorporating in close proximity with each of the two or more EM test lines within the circuit one or more leakage current type extrusion monitors.

Lowitz et al. discloses an extrusion detector including the step of incorporating in close proximity with each of the two or more EM test lines within the circuit one or more leakage current type extrusion monitors (fig. 3).

Therefore, it would have been obvious to one skilled in the art at the time of the invention to incorporate the leakage current type extrusion monitor of Lowitz et al. into the method and apparatus of Usui for the purpose of making the detector more reliable by adding redundancy to the sensing.

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Art Unit: 2858

The following patent is cited to show the state of the art with respect to detecting extrusions.

USPN 5,777,486 to Hsu: This patent shows an apparatus for resistively detecting damage to conductors due to electromigration.

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy J. Dole whose telephone number is (571) 272-2229. The examiner can normally be reached on Mon. thru Fri. from 8:00 to 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diane Lee can be reached on (571) 272-2399. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TJD




ANJAN DEB
PRIMARY EXAMINER